

[ 1] At the close of our meeting on November 21, concerning possible acceleration of the manned lunar landing program, you requested that I describe for you the priority of this program in our over-all civilian space effort. This letter has been prepared by Dr. Dryden, Dr. Seamans, and myself to express our views on this vital question.

The objective of our national space program is to become preeminent in all important aspects of this endeavor and to conduct the program in such a manner that our emerging scientific, technological, and operational competence in space is clearly evident.

To be preeminent in space, we must conduct scientific investigations on a broad front. We must concurrently investigate geophysical phenomena about the earth, analyze the sun's radiation and its effect on earth, explore the moon and the planets, make measurements in interplanetary space, and conduct astronomical measurements.

To be preeminent in space, we must also have an advancing technology that permits increasingly large payloads to orbit the earth and to travel to the moon and the planets. We must substantially improve our propulsion capabilities, must provide methods for delivering large amounts of internal power, must develop instruments and life support systems that operate for extended periods, and must learn to transmit large quantities of data over long distances.

To be pre-eminent in operations in space, we must be able to launch our vehicles at prescribed times. We must develop the capability to place payloads in exact orbits. We must maneuver in space and rendezvous with cooperative spacecraft and, for knowledge of the military potential with uncooperative spacecraft. We must develop techniques for landing on the moon and the planets, and for re-entry into the earth's atmosphere at increasingly high velocities. Finally, we must learn the process of fabrication, inspection, assembly, and check-out that will provide vehicles with life expectancies in space measured in years rather than months. Improved reliability is required for astronaut safety, long duration scientific measurements, and for economical meteorological and communications systems.

[ 2] In order to carry out this program, we must continually up-rate the competence of Government research and flight centers, industry, and universities, to implement their special assignments and to work together effectively toward common goals. We also must have effective working relationships with many foreign countries in order to track and acquire data from our space vehicles and to carry out research projects of mutual interest and to utilize satellites for weather forecasting and world-wide communications.

#### Manned Lunar Landing Program

NASA has many flight missions, each directed toward an important aspect of our national objective. The manned lunar landing program requires for its successful completion many, though not all, of these flight missions. Consequently, the manned lunar landing

program provides currently a natural focus for the development of national capability in space and, in addition, will provide a clear demonstration to the world of our accomplishments in space. The program is the largest single effort within NASA, constituting three-fourths of our budget, and is being executed with the utmost urgency. All major activities of NASA, both in headquarters and in the field, are involved in this effort, either partially or full time.

In order to reach the moon, we are developing a launch vehicle with a payload capability 85 times that of the present Atlas booster. We are developing flexible manned spacecraft capable of sustaining a crew of three for periods up to 14 days. Technology is being advanced in the areas of guidance and navigation, re-entry, life support, and structures -- in short, almost all elements of booster and spacecraft technology.

The lunar program is an extrapolation of our Mercury experience. The Gemini spacecraft will provide the answers to many important technological problems before the first Apollo flights. The Apollo program will commence with earth orbital maneuvers and culminate with the one-week trip to and from the lunar surface. For the next five to six years there will be many significant events by which the world will judge the competence of the United States in space.

The many diverse elements of the program are now being scheduled in the proper sequence to achieve this objective and to emphasize the major milestones as we pass them. For the years ahead,

each of these tasks must be carried out on a priority basis.

[ 3] Although the manned lunar landing requires major scientific and technological effort, it does not encompass all space science and technology, nor does it provide funds to support direct applications in meteorological and communications systems. Also, university research and many of our international projects are not phased with the manned lunar program, although they are extremely important to our future competence and posture in the world community.

#### Space Science

As already indicated, space science includes the following distinct areas: geophysical, solar physics, lunar and planetary science, interplanetary science, astronomy, and space biosciences.

At present, by comparison with the published information from the Soviet Union, the United States clearly leads in geophysics, solar physics, and interplanetary science. Even here, however, it must be recognized that the Russians have within the past year launched a major series of geophysical satellites, the results of which could materially alter the balance. In astronomy, we are in a period of preparation for significant advances, using the Orbiting Astronomical Observatory which is now under development. It is not known how far the Russian plans have progressed in this important area. In space biosciences and lunar and planetary science, the Russians enjoy a definite lead at the present time. It is therefore essential that we push forward with our own programs in each of these important scientific areas in order to retrieve or maintain

our lead, and to be able to identify those areas, unknown at this time, where an added push can make a significant breakthrough.

A broad-based space science program provides necessary support to the achievement of manned space flight leading to lunar landing. The successful launch and recovery of manned orbiting spacecraft in Project Mercury depended on knowledge of the pressure, temperature, density, and composition of the high atmosphere obtained from the nation's previous scientific rocket and satellite program. Considerably more space science data are required for the Gemini and Apollo projects. At higher altitudes than Mercury, the spacecraft will approach the radiation belt through which man will travel to reach the moon. Intense radiation in this belt is a major hazard to the crew. Information on the radiation belt will determine the shielding requirements and the parking orbit that must be used on the way to the moon.

[ 4] Once outside the radiation belt, on a flight to the moon, a manned spacecraft will be exposed to bursts of high speed protons released from time to time from flares on the sun. These bursts do not penetrate below the radiation belt because they are deflected by the earth's magnetic field, but they are highly dangerous to man in interplanetary space.

The approach and safe landing of manned spacecraft on the moon will depend on more precise information on lunar gravity and topography. In addition, knowledge of the bearing strength and roughness of the landing site is of crucial importance, lest the landing module topple or sink into the lunar surface.

Many of the data required for support of the manned lunar landing effort have already been obtained, but as indicated above there are many crucial pieces of information still unknown. It is unfortunate that the scientific program of the past decade was not sufficiently broad and vigorous to have provided us with most of these data. We can learn a lesson from this situation, however, and proceed now with a vigorous and broad scientific program not only to provide vital support to the manned lunar landing, but also to cover our future requirements for the continued development of manned flight in space, for the further exploration of space, and for future applications of space knowledge and technology to practical uses.

#### Advanced Research and Technology

The history of modern technology has clearly shown that pre-eminence in a given field of endeavor requires a balance between major projects which apply the technology, on the one hand, and research which sustains it on the other. The major projects owe their support and continuing progress to the intellectual activities of the sustaining research. These intellectual activities in turn derive fresh vigor and motivation from the projects. The philosophy of providing for an intellectual activity of research and an interlocking cycle of application must be a cornerstone of our National Space Program.

The research and technology information which was established by the NASA and its predecessor, the NACA, has formed the foundation for this nation's preeminence in aeronautics, as exemplified by our

military weapons systems, our world market in civil jet airliners, and the unmatched manned flight within the atmosphere represented by the X-15.

[ 5] More recently, research effort of this type has brought the TFX concept to fruition and similar work will lead to a supersonic transport which will enter a highly competitive world market. The concept and design of these vehicles and their related propulsion, controls, and structures were based on basic and applied research accomplished years ahead. Government research laboratories, universities, and industrial research organizations were necessarily brought to bear over a period of many years prior to the appearance before the public of actual devices or equipment.

These same research and technological manpower and laboratory resources of the nation have formed a basis for the U. S. thrust toward pre-eminence in space during the last four years. The launch vehicles, spacecraft, and associated systems including rocket engines, reaction control systems, onboard power generation, instrumentation and equipment for communications, television and the measurement of the space environment itself have been possible in this time period only because of past research and technological effort. Project Mercury could not have moved as rapidly or as successfully without the information provided by years of NACA and later NASA research in providing a base of technology for safe re-entry heat shields, practical control mechanisms, and life support systems.

It is clear that a pre-eminence in space in the future is

dependent upon an advanced research and technology program which harnesses the nation's intellectual and inventive genius and directs it along selective paths. It is clear that we cannot afford to develop hardware for every approach but rather that we must select approaches that show the greatest promise of payoff toward the objectives of our nation's space goals. Our research on environmental effects is strongly focused on the meteoroid problem in order to provide information for the design of structures that will insure their integrity through space missions, Our research program on materials must concentrate on those materials that not only provide meteoroid protection but also may withstand the extremely high temperatures which exist during re-entry as well as the extremely low temperatures of cryogenic fuels within the vehicle structure. Our research program in propulsion must explore the concepts of nuclear propulsion for early 1970 applications and the even more advanced electrical propulsion systems that may become operational in the mid 1970's. A high degree of selectivity must be and is exercised in all areas of research and advanced technology to ensure that we are working on the major items that contribute to the nation's goals that make up an over-all pre-eminence in space exploration. Research and technology must precede and pace these established goals or a stagnation of progress in space will inevitably result.

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#### Space Applications

The manned lunar landing program does not include our satellite applications activities. There are two such program areas under way

and supported separately: meteorological satellites and communications satellites. The meteorological satellite program has developed the TIROS system, which has already successfully orbited six spacecraft and which has provided the foundation for the joint NASA-Weather Bureau planning for the national operational meteorological satellite system. This system will center on the use of the Nimbus satellite which is presently under development, with an initial research and development flight expected at the end of 1963. The meteorological satellite developments have formed an important position for this nation in international discussions of peaceful uses of space technology for world benefits.

NASA has under way a research and development effort directed toward the early realization of a practical communication satellite system. In this area, NASA is working with the Department of Defense on the Syncom (stationary, 24-hour orbit, communications satellite) project in which the Department of Defense is providing ground station support for NASA's spacecraft development; and with commercial interests, for example, AT&T on the Telstar project. The recent "Communications Satellite Act of 1962" makes NASA responsible for advice to and cooperation with the new Communications Satellite Corporation, as well as for launching operations for the research end/or operational needs of the Corporation. The details of such procedures will have to be defined after the establishment of the Corporation. It is clear, however, that this tremendously important application of space technology will be dependent on NASA's support for early development and implementation.

### University Participation

In our space program, the university is the principal institution devoted to and designed for the production, extension, and communication of new scientific and technical knowledge. In doing its job, the university intimately relates the training of people to the knowledge acquisition process of research. Further, they are the only institutions which produce more trained people. Thus, not only do they yield fundamental knowledge, but they are the sources of the scientific and technical manpower needed generally for NASA to meet its program objectives.

In addition to the direct support of the space program and the training of new technical and scientific personnel, the university is uniquely qualified to bring to bear the thinking of multidisciplinary [ 7] groups on the present-day problems of economic, political, and social growth. In this regard, NASA is encouraging the universities to work with local industrial, labor, and governmental leaders to develop ways and means through which the tools developed in the space program can also be utilized by the local leaders in working on their own growth problems. This program is in its infancy, but offers great promise in the working out of new ways through which economic growth can be generated by the spin-off from our space and related research and technology.

### International Activity

The National Space Program also serves as the basis for international projects of significant technical and political value. The peaceful purposes of these projects have been of importance in

opening the way for overseas tracking and data acquisition sites necessary for manned flight and other programs which, in many cases, would otherwise have been unobtainable. Geographic areas of special scientific significance have been opened to cooperative sounding rocket ventures of immediate technical value. These programs have opened channels for the introduction of new instrumentation and experiments reflecting the special competence and talent of foreign scientists. The cooperation of other countries -- indispensable to the ultimate achievement of communication satellite systems and the allocation of needed radio frequencies -- has been obtained in the form of overseas ground terminals contributed by those countries. International exploitation and enhancement of the meteorological experiments through the synchronized participation of some 35 foreign nations represent another by-product of the applications program and one of particular interest to the less developed nations, including the neutrals, and even certain of the Soviet bloc satellite nations.

These international activities do not in most cases require special funding; indeed, they have brought participation resulting in modest savings. Nevertheless, this program of technical and political value can be maintained only as an extension of the underlying on-going programs, many of which are not considered part of the manned lunar landing program, but of importance to space science and direct applications.

#### Summary and Conclusion

In summarizing the views which are held by Dr. Dryden, Dr.

Seamans, and myself, and which have guided our joint efforts to develop the National Space Program, I would emphasize that the manned lunar landing [8] program, although of highest national priority, will not by itself create the pre-eminent position we seek. The present interest of the United States in terms of our scientific posture and increasing prestige, and our future interest in terms of having an adequate scientific and technological base for space activities beyond the manned lunar landing, demand that we pursue an adequate, well-balanced space program in all areas, including those not directly related to the manned lunar landing. We strongly believe that the United States will gain tangible benefits from such a total accumulation of basic scientific and technological data as well as from the greatly increased strength of our educational institutions. For these reasons, we believe it would not be in the nation's long-range interest to cancel or drastically curtail on-going space science and technology development programs in order to increase the funding of the manned lunar landing program in fiscal year 1963.

The fiscal year 1963 budget for major hardware development and flight missions not part of the manned lunar landing program, as well as the university program, totals \$400 million. This is the amount which the manned space flight program is short. Cancellation of this effort would eliminate all nuclear developments, our international sounding rocket projects, the joint U.S.-Italian San Marcos project recently signed by Vice President Johnson, all of our planetary and astronomical flights, and the communication and

meteorological satellites. It should be realized that savings to the Government from this cancellation would be a small fraction of this total since considerable effort has already been expended in fiscal year 1963. However, even if the full amount could be realized, we would strongly recommend against this action.

In aeronautical and space research, we now have a program under way that will insure that we are covering the essential areas of the "unknown." Perhaps of one thing only can we be certain; that the ability to go into space and return at will increases the likelihood of new basic knowledge on the order of the theory that led to nuclear fission.

Finally, we believe that a supplemental appropriation for fiscal year 1963 is not nearly so important as to obtain for fiscal year 1964 the funds needed for the continued vigorous prosecution of the manned lunar landing program (\$4.6 billion) and for the continuing development of our program in space science (\$670 million), advanced research and technology (\$263 million), space application (\$185 million), and advanced manned flight including nuclear propulsion (\$485 million).

[ 9] The funds already appropriated [hermit us tn maintain a driving, vigorous program in the manned space flight area aimed at a target date of late 1967 for the lunar landing. WF are concerned that the efforts required to pass a supplemental bill through the Congress, coupled with Congressional reaction to the practice of deficiency spending, could adversely affect our appropriations for fiscal year 1964 and subsequent years, and permit critics to focus

on such items as charges that "overruns stem from poor management instead of on the tremendous progress we have made and are making.

As you know, we have supplied the Bureau of the Budget complete information on the work that can be accomplished at various budgetary levels running from \$5.2 billion to \$6.6 billion for fiscal year 1964. We have also supplied the Bureau of the Budget with carefully worked out schedules showing that approval by you and the Congress of a 1964 level of funding of \$6.2 billion together with careful husbanding and management of the \$3.7 billion appropriated for 1963 would permit maintenance of the target dates necessary for the various milestones required for a final target date for the lunar landing of late 1967. The jump from \$3.7 billion for 1963 to \$6.2 billion for 1964 is undoubtedly going to raise more questions than the previous year jump from \$1.8 billion to \$3.7 billion.

If your budget for 1964 supports our request for \$6.2 billion for NASA, we feel reasonably confident we can work with the committees and leaders of Congress in such a way as to secure their endorsement of your recommendation and the incident appropriations. To have moved in two years from President Eisenhower's appropriation request for 1962 of \$1.1 billion to the approval of your own request for \$1.8 billion, then for \$3.7 billion for 1963 and on to \$6.2 billion for 1964 would represent a great accomplishment for your administration. We see a risk that this will be lost sight of in charges that the costs are skyrocketing, the program is not under control, and so forth, if we request a supplemental in fiscal year

1963.

However, if it is your feeling that additional funds should be provided through a supplemental appropriation request for 1963 rather than to make the main fight for the level of support of the program on the basis of the \$6.2 billion request for 1964, we will give our best effort to an effective presentation and effective use of any funds provided to speed up the manned lunar program.

With much respect, believe me

Sincerely yours,

James E. Webb

Administrator